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Fault Patterns as indicators for increasing Strain: a Remote Sensing Approach

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From the North Tanzanian Divergence to the Afar Triple Junction (R-R-R), the Eastern Branch of the East African Rift System (EARS) presents all states of extensional deformation. From purely continental rift in the South to incipient break-up in the Main Ethiopian Rift (MER) the EARS is an ideal laboratory to explore fault processes. We use satellite image processing in order to quantify the deformation style and localization in 4 selected areas. The image processing including automatic fault extraction using object oriented classifications and the statistical and fractal analysis of objects and images allow us to characterize the fault dimensions distributions and strain localizations. The selected areas in Northern Tanzania, South and Central Kenya and in the MER represent extensional zones with increasing strain. We show that increasing strain modify the deformation style and localization that can be quantified by fault statistics. We show that oblique rifting seems to be an intrinsic propriety of rifting. Faults statistics allow us to model brittle deformation at different stages of rifting: from half-grabens controlled by border faults, to diffuse deformation and finally to the extreme localization of strain into narrow, $<$20km wide, zones where magmatism and faulting is intimately linked (Tectono-Magmatic Segments).